

Inside-Out Manufacturing of Composite Structures

Completed Technology Project (2012 - 2012)



Project Introduction

Tooling for the manufacture of large structures from composite materials often costs much more than individual parts, rendering the processes unattractive for prototype designs. A new design for manufacturing philosophy for multifunctional composite structures is suggested that does not require the use of hard tooling to form large complex shapes. By utilizing a thin rigid and form-able pre-form such as a metal screen or foam core, fiber reinforcement may be tacked into place and vacuum bagged on both sides to perform resin infusion without the need for any tooling. The process is expected to be scalable and capable of forming large structures including most shapes envisioned for launch vehicles, exploration vehicles, and habitats. The process will also be applicable to architecture and commercial industrial process equipment such as cooling towers and offshore platforms. The process could reduce the cost of manufacturing composite prototype structures by more than one-half by eliminating the need for hard tooling.

Demonstrate the inside-out manufacturing process by manufacturing a complex shaped composite structure with imbedded wiring and fluid handling without the use of a tooling form. Utilize the core as the tool and build parts from the inside-out, placing utilities before composite structure.

Anticipated Benefits

The design for manufacturing philosophy of inside-out manufacturing for multifunctional composite structure could enable reduced mass and lower production cost for small vehicles such as the MMSEV, robotic components such as in R2 or exoskeleton, and propulsion systems such as SLS.



Project Image Inside-Out Manufacturing of Composite Structures

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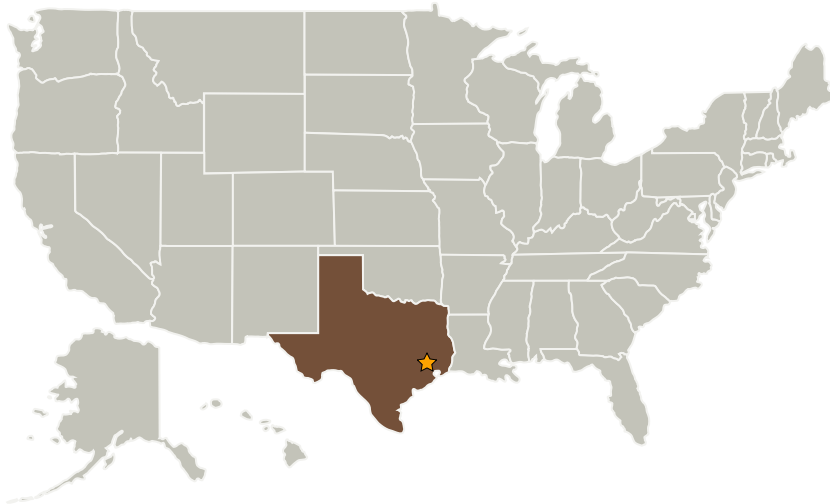
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations

Texas

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Innovation Fund: JSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Carlos H Westhelle

Project Manager:

Charles S Hill

Principal Investigator:

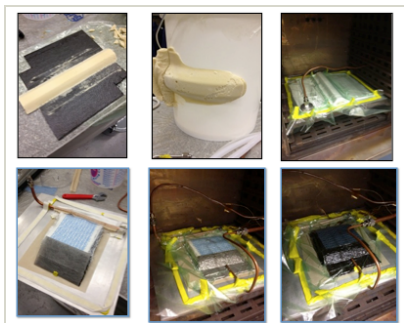
Charles S Hill

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Images



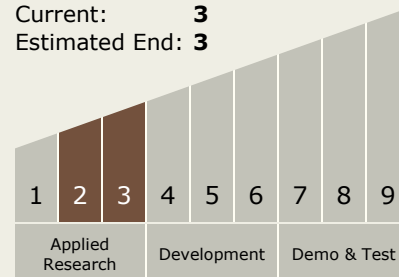
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Project Image Inside-Out
Manufacturing of Composite
Structures

(<https://techport.nasa.gov/image/2243>)

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.1 In-space Propellant Storage & Utilization